CLAIMS

1. A micromechanical rotation rate sensor provided with a wafer stack arrangement, comprising:

   a substrate wafer arrangement (12, 16);

   a structural wafer arrangement (14, 18) in which there are defined at least one seismic mass (20; 20a; 20b), the suspension (24) of said seismic mass and at least one spring means (22a, 22b; 22c) for connecting the suspension (24) to said seismic mass; and

   an insulating organic connecting layer (15) which mechanically connects the substrate wafer arrangement to the structural wafer arrangement in such a way that the seismic mass can carry out an excitation oscillation and that at least part of the seismic mass can carry out a detection oscillation on the basis of a rotation rate relative to the substrate wafer arrangement (12, 16).

2. A micromechanical rotation rate sensor according to claim 1, wherein the substrate wafer arrangement (12, 16) includes a substrate wafer (12) and a metallization (16) on the substrate-wafer side facing the organic connecting layer (15), the metallization (16) having planar detection electrodes (34a, 34b) below the seismic mass (20; 20a, 20b) so as to obtain a capacitive detection means of the detection oscillation on the basis of the Coriolis force.

3. A micromechanical rotation rate sensor according to claim 1 or 2, wherein the structural wafer arrangement (14, 18) additionally includes a comb drive means (26, 28) for producing an excitation oscillation of the seismic mass (20; 20a; 20b), a stationary portion (26a, 28a) of the comb drive means having a metallization (18) through which an electric voltage can be applied to the comb drive means.

4. A micromechanical rotation rate sensor according to one of the preceding claims, wherein the seismic mass (20; 20a, 20b) is provided with through holes (21) which are arranged in such a way that, making use of lateral etching, the organic connecting layer (15) below the seismic mass can be removed in such a way that the seismic mass can

carry out the excitation oscillation and that at least part of the seismic mass can carry out the detection oscillation relative to the substrate wafer arrangement (12, 16).

5. A micromechanical rotation rate sensor according to one of the preceding claims, wherein the substrate wafer arrangement includes buried electrodes (35a, 35b) below the seismic mass (20a, 20b).

6. A micromechanical rotation rate sensor according to one of the preceding claims, wherein both the substrate wafer arrangement and the structural wafer arrangement may be provided with a semiconductor wafer (12, 14) consisting of monocrystalline silicon.

7. A micromechanical rotation rate sensor according to one of the claims 3 to 6, wherein portions of the metallization (16) of the substrate wafer arrangement and of the metallization (18) of the structural wafer arrangement are connected via a connection metallization (46) in such a way that connecting areas for the rotation rate sensor are located on the same level relative to the substrate wafer arrangement (12, 16).

8. A micromechanical rotation rate sensor according to one of the preceding claims, wherein the thickness (d) of the substrate wafer arrangement (14, 18) is at most 50 times, and preferably 20 to 30 times as thick as the thickness of the organic connecting layer (15).

9. A micromechanical rotation rate sensor according to one of the preceding claims, wherein a plurality of seismic masses (20a, 20b) is defined in the structural wafer arrangement.

10. A micromechanical rotation rate sensor according to one of the preceding claims, comprising in addition:

an excitation and evaluation circuit (44) which is monolithically integrated in the substrate wafer arrangement.

11. A micromechanical rotation rate sensor according to one of the preceding claims, wherein the organic connecting layer (15) consists of a polymer.

12. A micromechanical rotation rate sensor according to claim 11, wherein the organic connecting layer comprises polyimide, epoxy resin or thermoplastic materials.

13. A micromechanical rotation rate sensor according to one of the preceding claims, comprising in addition a cover wafer (54) which is connected to the structural wafer arrangement (14, 18) in such a way that a cavity is formed between the substrate wafer arrangement (12, 16) and said cover wafer (54).

14. A method for producing a micromechanical rotation rate sensor comprising the following steps:

    a) providing a substrate wafer arrangement (12; 16);

    b) providing a structural wafer arrangement (14, 18);

    c) mechanically connecting the substrate wafer arrangement and the structural wafer arrangement by means of an insulating organic connecting layer (15) so as to obtain a wafer stack arrangement;

    d) structuring the structural wafer arrangement of the wafer stack arrangement so as to define at least one seismic mass (20; 20a, 20b), a suspension (24) and a spring means (22a, 22b; 22c) for connecting the suspension (24) to the seismic mass (20; 20a; 20b); and

    e) removing the organic connecting layer (15) at least below the seismic mass in such a way that the seismic mass can carry out an excitation oscillation and that at least part of the seismic mass can carry out a detection oscillation on the basis of a rotation rate relative to the substrate wafer arrangement.

15. A method according to claim 14, wherein step a) comprises the following substeps:

providing a semiconductor waver (12);

metallizing (16) the semiconductor wafer (12); and

structuring the metallization (16) so as to form at least one electrode (34a, 34b) which is placed below the seismic mass (20; 20a, 20b) so as to obtain the substrate wafer arrangement (12, 16).

16. A method according to claim 14, wherein step a) comprises the following substeps:

providing a semiconductor wafer (12);

forming in the semiconductor wafer (12) a buried electrode (35a, 35b), which is placed below the seismic mass (20; 20a, 20b), so as to obtain the substrate wafer arrangement.

17. A method according to one of the claims 14 to 16, wherein step d) is carried out by dry-etching the structural wafer arrangement, the organic connecting layer (15) acting as an etch stop.

18. A method according to one of the claims 14 to 17, wherein step e) is carried out by dry-etching, only the organic connecting layer being selectively etched in said dry-etching step.

19. A method according to claim 18, wherein in step d) a plurality of through holes (21) is formed in the seismic mass (20a, 20b) by structuring, and wherein in step e) the organic connecting layer (15) is etched away in the through holes and laterally below the through holes.

20. A method according to one of the claims 14 to 19, comprising the following additional step which is carried out prior to step b):

thinning the structural wafer arrangement (14) to a predetermined thickness (d) so as to determine together with the lateral dimensions of the elements defined in step d) a

spring constant of the spring means and the mass of the seismic mass.

21. A method according to one of the claims 14 to 20, comprising the following additional step which is carried out prior to step a):

monolithically integrating an excitation and evaluation circuit (44) for the micromechanical rotation rate sensor in the substrate wafer (12) of the substrate wafer arrangement (12, 16).